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Sustainable Urban Development Strategy for Batu City, East Java Provinsi, Indonesia

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Abstract

Urbanization problems and sustainable development has become global issues and got a lot of attention from stakeholders in various countries. Indonesia as developing country faces their significant problem in urban management complexity. The city government take the real impact of development problems that increasingly difficult to control. Batu city is the youngest autonomous city in East Java province, Indonesia, located in the upper Brantas river and has steep slope topography. Since its establishment, Batu City has experienced the rapid economic and population growth whict allegedly also cause the increase of environmental degradation.

The purpose of this research is to analyze the sustainability index value of ecological, economic, socio-cultural, infrastructure and institutional dimensision in assessing the development sustainability status of Batu city using Multidimensional scaling (MDS) analysis, analyzing the sensitive attributes of sustainability dimensions using leverage analysis and develop the strategies in sustainable urban development using SWOT analysis. The results showed that the development sustainability status of Batu city, the ecological dimension in the category of less sustainable (46.90 %), the economic dimension is sustainable enough (56.52 %), the social dimensionis sustainable enuogh (60.40 %), the infrastructure dimension is sustainable enough (63.31 %), and the institutional dimensions in sustainable enough (72.68 %). Attributes that affect the sustainability status assessment in terms of the ecological dimension are water quality, air quality and biodiversity; in the review of the economic dimension are investment growth, price stability and tourism visitation; while from socio-cultural dimension are porverty, health and security; in terms of the dimensions of infrastructure are public sanitation , affordable hause and clean water pipeline; and the institutional dimension are development planning, information systems and local apparatus.

Keywords : sustainable Development, Urba Manegement,Sustainable City,Multidimensional Scaling (MDS)

1.Introduction

Today the world's population is concentrated in urban areas. Based on the 2005 Revision of World Urbanization propects, the urba population reached 49 % in 2005. Since the world's population is projected continue to urbanized, 60 % of the global population is expected to live in urban areas by 2030. In Asia, Indonesia has the highest annual growth rate of urban population with 4.2 %. Between the years 1970-2010 was born 53 new autonomous cities. Batu City is the youngest autonomous city in East Java province and experiencing rapid economic and population growth with a strategic role in the preservation of Brantas River Basin ecological resource. BatuCity with an area 19,908.70ha totaled, is one of the city thet is successful in building the

image of the region and attract investment to drevi the local economic with the cocept of Batu Tourism City (KWB). The success of Batu City development began to be overshadowed by a variety of issues such as environmental degradation, economic inequality and social friction. The future of Batu City and the welfare of its citizens are determined from the development strategy that is being executed at this time.

2. Theorectical

2.1. Sustainable Development

Development is a reflection of social change process in a society, without ignoring the diversity of basic needs and interests of individual and social groups or institutions that exist to achieve betterliving conditions (Todaro, 1998). While the term sustainable development (Brundtland Report of the United Nations, 1987) is a development process that includes not only the territory (land, city) but also all the elements, business, society and so principled "meets the need of the present without compromising the fulfillment of the needs of future generations:, appropriate in WECD report "Our Common Future" that sustainable development was formulated as follows: "Sustainable development is definied as development that meet the needs of the present without comprosing the ability of future generations to namely : economic, ecological and social objectives. Economic objectives relating to issues of efficiency and growth; ecological objectives related to conservation of natural resources; and environmental quality; and social objectives relatedto poverty reduction and equity. Thus, the goal of sustainable development is basically located on the harmonization between economic, ecological and social objectives. The fulfillment of these needs is closely related to how to conserve capital stock. Capital stock is comprised of three types, namely : nature capital, human capital and physical-built capital (Barbier, 1993).

2.2. Sustainable City

Urban Management is a contemporary approach to analyze urban problems. Urban Management Programme (UMP) introduces the context of urban management-oriented approach to the technocratic or handling issues, including how to achieve sustainable urban development. Brundtland report mentions that the sustainable city is a city that can perform the function and role in sustainable development. The city should be able to protect and preserve naturalresources in town and in the surrounding area that can be utilized in a sustainable manner. This means that not only the city itself but also continued its regional role and fuctions. Sustainable urban development ia a dynamic process that takes place on on going basis, is a response to pressure changes in the economic, environmental, and socio-cultural. Processes and policies are not the same in every city,depending on the character and its problems. One of the biggest challenges is creating sustainability concepts, including political and institutional sustainability of the system to the making of strategies, programs, and policies so that sustainable urban development can be maintained. Urban management approach used in creating a sustainable city is a holistic approach to city management is economically profitable, environmentally friendly, socially and politically acceptable by community and culturally sensitive (Korten, 1996). Every city should develop its own character, and more importantly, how the city can accommodate future development while maintaining a region that serves to protect the life of the city and its people. In terms of urban planning in addition to facilitate the approach into the community to explain what the program will be planned ahead and increase the participation of urban communities to supports the local government strategy and he policy.

3. Methodology Of The Research

3.1. Scope of the Research

This research used quantitative descriptive method that is collect data and facts on the field. Material scope includes the sustainability analysis of ecological, economic, socio-culture, infrastructure and institutional dimensions. Scope of the location is Batu City which is covering Sub-districts of Batu, Bumiaji and Junrejo.

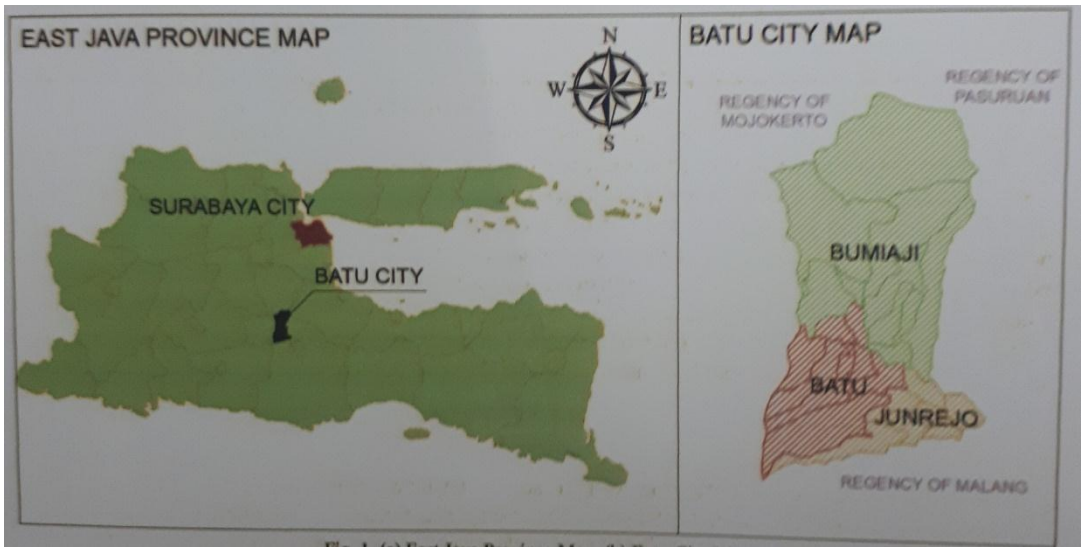

Fig. 1. (a) East Java Province Map; (b) Batu City Map

3.2. DataCollection Method

Data collection was conducted on the Primery Survey through observation of pedestrian path and disaster evacuation facilities in Central Business Distric of Batu City. Questionnaires about city leadership, public service and development planning to Batu citizen using proportional cluster sampling with a sample of 100 residents representing 24 villages. Secondary survey through recapitulation of government agencies database from year of 2008 to 2012 (5 years period), The main institutions for this research are City Development Planning Agency (Bappekot), Central Bureau of Statistics (BPS), Settlements and Spatial Affair Service (DCKTR) an Enviromental Office (KLH).

3.3. Data Analysis Method

The data analysis method used in this study there are two, namely (1) Ordination technique RAP-CITY, through the Multi Dimensional Scaling method (MDS) to assess the status of index and development sustainability in Batu City and identify sensitive attributes the sustainability index in each dimension through leverage analysis; (2) SWOT analysis to develop sustainability urban development strategies for Batu City.

RAP-City ordination techniques through the Multi Dimensional Scaling method (MDS) is a statistical technique that tries to transform multidimensional be more modest dimensions (Kavanagh, 2001). RAP City ordination technique is a modification of RAPFISH developed by the University of British Columbia, Canada to assess the sustainability of system. Analysis of RAP-City ordinated with MDS method in this study, carried out in phases; Determination of dimensions and attributes, in the study there were five has 8 attributes; Assessment of each attribute in an ordinal scale (scoring) with a range of scores ranging from 1-3 based on sustainability criteria for each dimensions; The results of the scoring and then analyzed using the software MDS in order to obtain the results to determine the sensitive variables affecting sustainability, montecarlo analysis results to calculate the aspect of uncertainty; as well as the stress value and the coefficient of determination for determining the accuracy of the study attribute. Stress value allowed when under 25% while R^2 is expected to approach the value of 1.

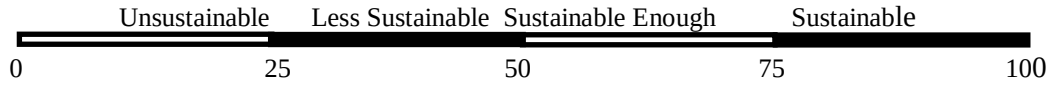

Fig. 2. Sustainability index value in ordination scale illustration

Ordination tecniques (spacing) in MDS is based on Euclidian Distance that the n-dimensional space according to the equation (1). The point is then approximated by regressing Euclidean distance (d_{ij}) from point I to point j to the point of origin (d_{ij}) according to equation (2). In regressing the above equation is used technique alternately squared least based on the root of the Euclidian Distance (squared distance) or the so-called method ASCAL algorithm. This method optimizes the square distance (squared distance = d_{ij}) to the square of the data (origin = O_{ij}) that in three dimensions (I, j, k) is called the S – stress according to the equation (3).

$$d = \sqrt{\langle x_{1-}x_2|\ \ ^2|y_1 - y_2|\ \ ^2 + |y_1 - y_2|\ \ ^2 + \cdots..|\rangle}$$

$$d_{ij} = a + bd_{ij} + e$$

$$s = \sqrt{\frac{1}{m}\sum\left[\frac{\sum\sum\ (d_{ij}^2 - O_{ijk}^2)\ \ ^2}{\sum\sum O_{ijk}^4}\right]}$$

Formulation of development strategis using SWOT analysis is conducted in stages: Writing the opportunities and threats of the external factors as well as the strength and weakness of internal factors; Conduct a SWOT analysis is a comparison between the external factors opportunities and threats to the internal factor strengths and weaknesses; The results of the analysis are then interpreted and developed into a decision that allows the selection of strategies to be implemented (Rangkuti, 2003)

4. Results Highlight

4.1 Urban Development Sustainability Status

Status of the sustainability development of Batu examined using analysis of Multi Dimensional Scaling (MDS), the stress value obtained from research on all dimensions already meet the goodness of fit due to stress value obtained is less than 25% with range of 13,9% - 14,4%. The confidence interval is quite high given that the value of R^2 close to 1 with range of 0,945 – 0,947. The result of Monte-Carlo analysis shows that the results do not experience any difference with the results of the analysis of MDS. This means that errors in the analysis and the data analysis process an be minimized.

Table 1. Multidimensional Scaling (MDS) analysis result

Dimension	Sustainability Indexs (MDS)	Sustainability Status	Sustainability Index (Monte-Carlo)	Stress	R^2
Ecology	46,90%	Less Sustainable	46,56%	14,3%	0,947
Economic	56,52%	Sustainable Enough	55,87%	13,9%	0,946
Socio-Culture	60.40%	Sustainable Enough	59,75%	14,4%	0,945
Infrastructure	63,31%	Sustainable Enough	61,62%	13,9%	0,947
Institutional	72,68%	Sustainable Enough	70,50%	14,0%	0,945
Multidimensional	59,96%	Sustainable Enough	58,86%	14,1%	0,946

The assessment result of urban development sustainability of Batu City in all dimensions are illustrated in the kite diagram. By multidimensional, urban development in Batu City is sustainable enough, except ecological dimension that has the status is less sustainable.

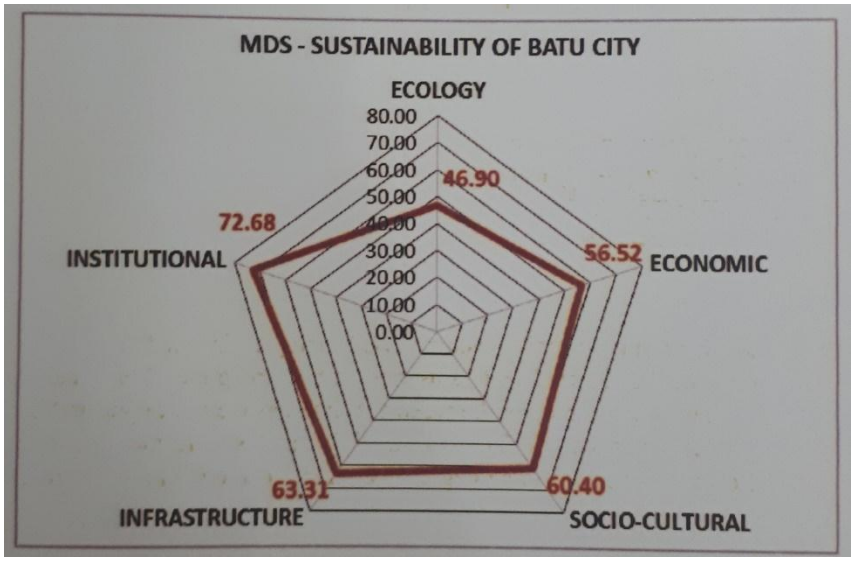

Fig. 3. Urban Development Sustainability Index od Batu City

4.2. Ecological Sustainability Aspect

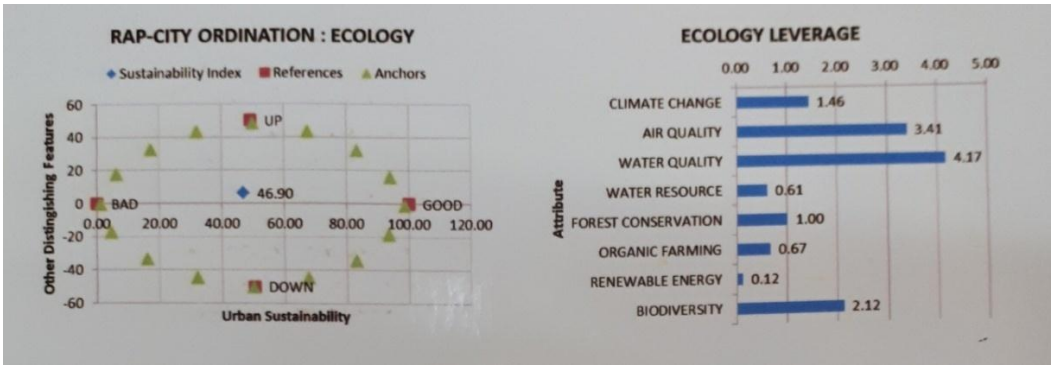

Fig. 4. (a) Rap-City Ordination of Ecology; (b) Ecology Leverage

The sensitive attributes consistsof: water quality (4.17), air quality (3.41) and biodiversity (2.12). Fresh water quality of rivers in Batu City is dominated by the Class III Quality Standard with high levels of TSS, BOD, COD exceeds the threshold quality standards. Only at monitoring points of Aboretum Brantas source adn Coban Talun sources that have water quality Class I, while the city's river has been polluted caused by farmland pesticides and household waste. Air quality in monitoring point is very good with the levels of SO_2, NO, O_3, Pb far below the threshold quality standards. Air Conditions of Batu City with low pollution is very safe for the health of city residents and tourist. Batu City's region is home to endemic wildlife, especially in forest areas. Forest conversion to plantations has damage the wildlife habitat and reduce20% of Javan langur and 45% Javan hawk population in 5 years.

Climate change (1.46) and forest conservatione (1.00) are quite sensitive attributes. Total CO_2 emissions generated by the activity of Batu City is 286,190 tons of CO_2 and increased 3.5% annually. The main source of greenhouse gas emissions in Batu City is the energy sector (72,5%), agriculture (23%), and waste (4,5%). Forest conservation program iis hampered by the expansion of land conservation, illegallogging and forest fires which resultedwidespread critical land. Critical land in Batu City within five years has increased from 101 ha to 250 ha. The main cause of degraded land expansion is conservation for the benefit of settlements, plantations and tourism reached 45.21 ha or approximately 0,07% per year. The forest area is an active absorber of CO_2 emissions and reduce the impact of climate change. Forest area in Batu Citty around 11,072.1 ha or 55.08% of the total area, is able to absorb 287,794 tons of CO_2 per year.

Organic farming (0,67), water resouces (0.61), and renewable energy (0.12) are the less sensitive attribute. Organic farming became one of the leading economic sectors with export-oriented commodities. Batu City Government is consistent expand organic farms 3 hectares per years. Organic farming is a agriculture technique that is able to maintain soil fertility in a sustainable manner. Potential reserves of water resources in Batu from source and rain water without soil water, amounting to 101.78 x 106 m^3. The total consumption of water resources is 77.538 x 106 m^3 and still a surplus balance. Problems of water resources are shrinking the amount and debit of source every year due to deforestation. Batu City has development program of alternative energy, biogas network construction in the Pesanggrahan and Sumberejo village, andalso extended to Oro-oro Ombo and Tlekung village which is located near the final waste processing site.

4.3 Economic Sustainability Aspect

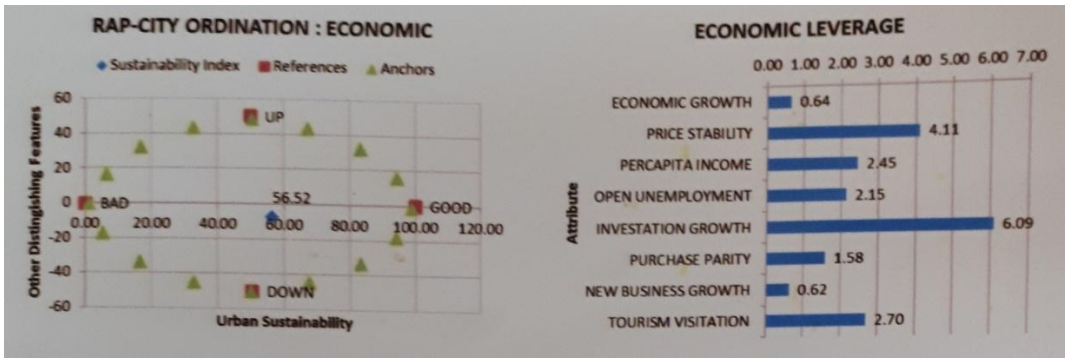

Fig. 5. (a) Rap-City Ordination of Economic; (b) Economic Leverage;

The sensitive attributes consists of: investment growth (6.09), price stability (4.11) and tourism visitation (2.7). Investment in Batu City increased average 16,61% per year, within a 5 years period, Batu City obtain investment of Rp. 9.3 trillion to the main sectors of Tourism and Hospitality. Granting investment licenses done very selective, especially with regard to spatial and scenic protection of the city. During 2008-2012, price stability or inflation rate of Batu City generally is higher than East Java, caused by increase of basic necessities prices, export of agricultural products and external economic factors, such as the price of gold and the price of subsidized fuel. Tourism Visistation in Batu City increased average 27.42% per year, above of local goernments expectations and target with 2.2 million tourists visit annually. Batu City has 14 tourist attraction objects and various annual Festival.

Percapita income (2.45), open unemployment (2.15) and purchase parity (1.58) are quite sensitive attributes. Batu City residents percapita income increased by 12.7% per year, higher than East Java average (12.6%). However, the value of Batu City GDP percapita lower than East Java average, in 2012 the Batu City per capita income Rp. 17,911,381.00 compared to East Java Rp. 26.32 million. Open unemployment rate in Batu City fell consistently from 8.95% in 2008 to 6.77% in 2012. Despite the decline in unemployment dramatically, but still higher than the unemployment rate in East Java (4.12%). Employment opportunities that exist often makes native Batu City not compete with people from outside the city, caused by level of education. Purchasing parity index of Batu City by 65.05%, lower than East Java average (66.06). Per capita income and purchasing parity index in Batu City more determined by external economic situation.

Economic Growth (0.64) and New Bussiness Growth (0.62) are the less sensitive attribute. Batu City's economic Growth from 2008 to 2011 increased constantly from 6.87% to 7.38%, and decreased slightly in 2012 to 6.83%. Nevertheless, the economic development of Batu City every year is always higher than the East Java. The main economic sectors of Batu City are trade, hotels and restaurants (49.28%), agriculture (17.68%) and Services (15.82%). Leading sectors according to the development plan of Batu City are tourism and agriculture. New business growth experienced positive, with the average advent of 1360 new business every year, an increase of 12.93% per year. During the period of 2008-2012, the growth of new business vey closely with the development of tourism facility, especially the SME business which became economic equity sector. Currently Batu City has 14,570 MSEs, MSE sector has accounted for 42% of Batu City's local revenue or approximately Rp. 54 billion.

4.4. Socio-cultural Sustainability Aspect

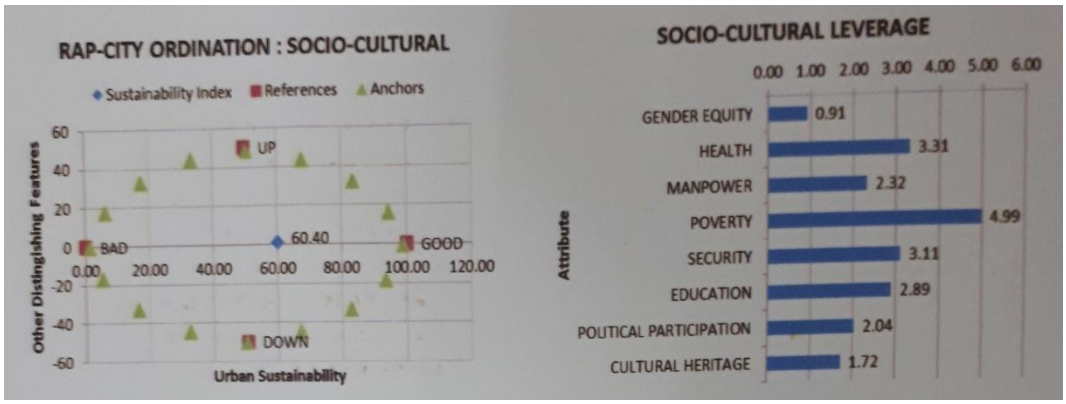

Fig. 6. (a) Rap-City Ordination of Socio-Cultural; (b) Socio-cultural Leverage;

The sensitive attributes consists of: poverty (4.99), Health (3.31) and security (3.11). Batu have significant proverty reduction from level of 11% become 7% in period of 2008-2012. The main cause of poverty in Batu City is access to jobs due to low levels of education and skills. The city government seeks index in Batu City increase from 68.87 to 69.66 year in period of 2008-2012. Increased life expectancy showed improvement of public health, but the government must be more vigilant in anticipation of heathcare and treatmennt of the elderly. Ratio of criminal case that have been solved in rang of 33%-43% varies each year . security threats and conventional crime, caused by economic pressures. Weak handling of crime also caused by individual law encforcement officers who tha case to take advantage.

Education (2.89), manpower (2.32), political participation (2.04) and cultural heritage (1.72) are quite sensitive attributes. In education sector, the progress of compulsoory education can be review from high schools net enrollment rate, it has increased over the period of 2008-2012, from 49% to 54.2%. the rate classified as medium, this is caused by direct desire to work in agriculture and the informal sector due to economic pressures. Comparison between productive and non-productive age population or dependency ratio, Batu City residents increased from 39.08% to 49.04% in the period 2008-2012. The economic burden of the labor force has increased and more compete with workers from outside the city to fill existing jobs. In the field of political participation, during the period 2008-2012, recorded voter turnout at 2008 Governor Election = 70.24%, 2009 legislative elections = 77.40%, 2009 Presidental Election= 78.98%, 2012 Mayor Election = 76.30%. the level of political participation varies greatly, in general is in the middle possition. Important fctor of people's political participation in Batu City is an emotional connection, primordialism and popilarity of the candidate. In the field of cultural preservation, the Batu City has a cultural heritage Bantengan, which is a cotemporary performing arts of dance, magic, music, and poctry. Batu City consistently fostering traditional cultural arts groups and continues to develop up to 74 arts groups. Gender equity (0.91) is the less sensitive attribute, the number of female labor force in the formal sector range increased from 3,244 into 3.,256 during the period 2008-2012, but the proportion is very small, only 3,2% of the total labor force. Low female equality in the formal sector is caused of education and cultural matter. There is a chain of connected issues between education, poverty, manpower, women's equality, security and political participation. Social assistance is needed to direct the marginalized communities to basic public services and alleviate social matter.

4.5 Infrastructure Sustainability Aspect

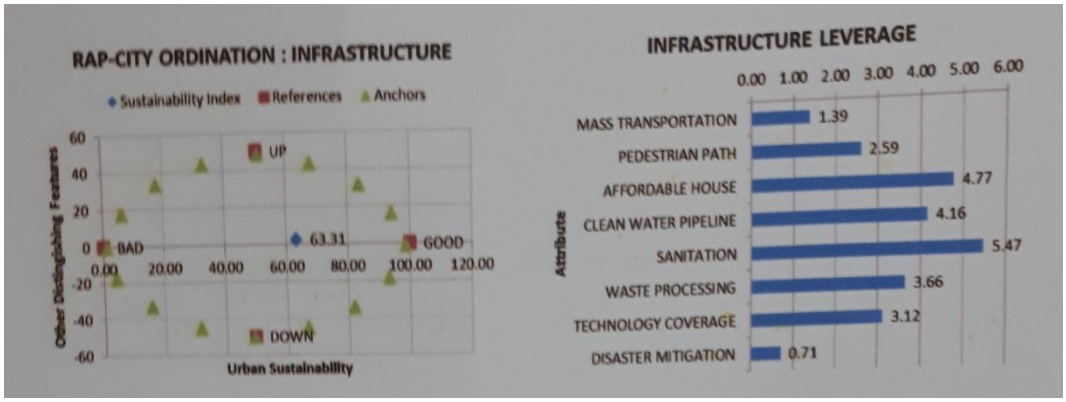

Fig. 7. (a) Rap-City Ordination of Infrastructure; (b) Infrastructure Leverage;

The sensitive attributes consists of: sanitation (5.47), affordable house (4.77) and clean water pipeline (4.16). The number of household that have sanitation, increase with a percentage 36 % become 81 % in period of 2008-2012. Most are onsite sewage treatment for domestic use as well as communal. Sanitation ownership ratio greatly affect the level of public health and the environment. Local government has facilitated affordable housing development, revitalize and decrease the number of of unappropriate house to 11,6%. Appropriate housing has a minimal element of space adequacy criteria, adequacy of living space, and the affordability of the price. The level of home ownership is strongly influenced by income levels. Clean water instalation of Batu City increase from 21,889 to 28,880 household or 31,39% in period of 2008-2012, but it only serve about 59,03% of all household. The slow expansion of water service is disputed source exploitation with Malang City and Malang Regency, so the construction of clean water pipeline installation is also inhibited.

Waste processing (3,66), technology coverage (3,12), pedistrian path (2,59) and mass tranportation (1,39) are quite sensitive attributes. The ratio of urban waste management decreased during the period of 2008-2012, from 52.02% to 38.10%. The low capacity of waste treatment system caused the distribution system of trash and garbage arrangement in the Tlekung landfill. In 2016, an estimated waste in the Tlekung landfill will full and Batu hit by the problem of garbage crisis. Electricity and telecommunications technology infrastructure supports economic development of the city. All villages in Batu City has reached 100% electrification ratio. The largest proportion of electricity users are households with low power 450 watts at 58.22%. Batu City reached by telematic networks, especially cellular networks with the establishment of BTS Tower by various telecommunications providers. Pedestrian path is a public space that support the activities of citizens, especially in the central business district. Based on observations, the condition of pedestrian path is quite safe and representative, but still less aesthetically and not provided with the means of supporting such a bridge crossing and seating for rest and shade. Public transportation (angkota), has been connecting accessibility to the entire village in Batu City. The City required public transport that was cheap and convenient, especially to cater to the tourists attractions. Disaster mitigation (0.71) is the less sensitive attribute, Batu City has a lot of public open space that could be used as muster point in emergency condition. However, the provision of information placard safety and disaster evacuation paths, especially in public places is still very minimal. Awareness of the importance of signs and evacuation facilities is needed to increase.

4.6 Institutional Sustainability Aspect

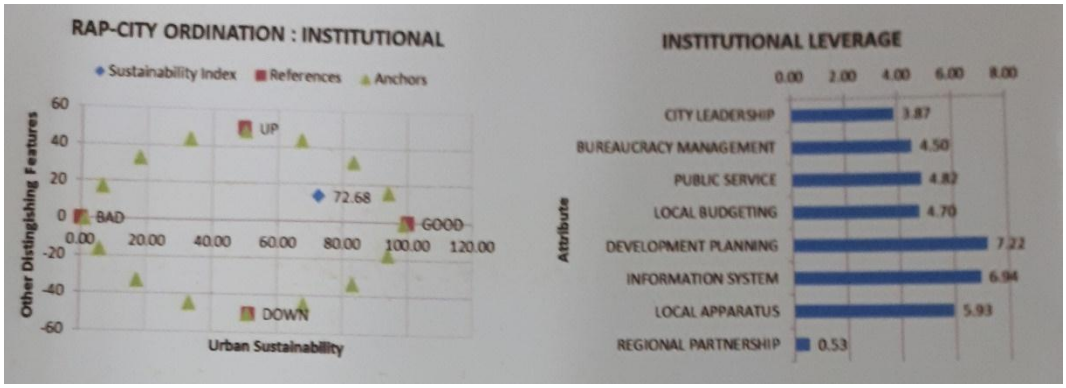

Fig. 8.(a) Rap-City Ordination Of Institutional; (b) Institutional Leverage;

The sensitive attributes consists of: development planning (7.22), information systems (6,94) and local apparatus (5,93). Public participation in "musrembang" is low and the dissemination of the results are limited only to village apparatus. Musrembang is public discussion and advocacy for development plans initiated by various elements of the community and facilitated by government. Musrembang is a bottom up planning implementation, but is merely ceremonial activities, since the approval of the development program is returned to the government to be carried back by the community. Use of information systems has been carried out for internal administration systems help people to again access to public disclosure. In local apparatus aspect, number of officials already accordance with operational needs, some have received scholarships of higher education and training, but lack of work innovation.

Public service (4,82), local budgeting (4,70), bureaucracy management (4,50), city leadership (3,87) are quite sensitive attributes. Public services in Batu City judged by the public with the satisfaction index of 78,87% is included in the category of "B" or performance of "Good". Public service in Batu City supported by a reliable officer, clarity of procedures and costs, as well as prompt delivery, and on schedule. The level of budgetary independence of Batu City is quite good, with ratio of 5,17%. Batu City increased the local revenue of Rp. 19,3 billion to Rp. 38,7 billion during the period of 2008-2012, or increased 20,01% per year. Good governance is also applied in Batu City, by providing all the standard operating procedures in the city's agencies. The availability of SOP is not enough to realized the organizational culture that leads to the development of professionalism, productivity and innovation. The city leadership is important factor in the formulation of city's vision-mission and goals, directing and evaluating the targets of bureaucracy and development progress. Mayor plans in development strategies with the concept of tourism and agriculture, assessed by the mayor and the community are also intertwined. Regional partnership (0,53) is an attribute that is less sensitive, this aspect gives a lot of great opportunities for the development of Batu City through the expansion of cooperation agreements with other local governments, domestic and foreign NGOs, private sector and other countries. The partnership program includes research and development, community empowering, and economic investment.

4.7. Sustainable Urban Development Strategy

SWOT analysis is used as consideration to establish a sustainable urban development for Batu City. The analysis results of internal factor (IFAS) and external factor (EFAS) of urban development in Batu City shows the value of X = +0,80 ; Y = +0,24, therefore use aggressive strategy.

Table 2. Internal and External Factor Of Batu City

Strenght (+)	Weakness (-)	Opportunity (+)	Threat (-)
Air Quality (0,2) Renewable energy (0,06) New Business Growth (0,008) Tourism Visistation (0,015) Education (0,06) Health (0,12) Poverty (0,2) Political Participation (0,08) Cultural Heritage (0,06) Mass Transportation (0,06) Affordable House (0,16) Clean Water Pipeline (0,09) Sanitation (0,2) Technology Coverage (0,08) City Leadership (0,08) Bureaucracy Mgt. (0,06) Information System (0,06) Local Apparatus (0,06)	Water Quality (0,012) Forest Conserv. (0,09) Biodiversity (0,12) Manpower (0,08) Security (0,09) Gender Equality (0,2) Pedestrian (0,04) Waste processing (0,09) Disaster Mitigation (0,08) Devl. Planning (0,15)	Organic Farming (0,08) Economic Growth (0,08) Investation Growth (0,2) Public Service (0,08) Local Budgeting (0,08) Reg. Partnership (0,1)	Climate Change (0,06) Water Resources (0,04) Price Stability (0,06) Percapita Income (0,09) Open Uneployment (0,09) Purchase Parity (0,04)
Internal Factor →X = +0.80		External Factor →Y = +0.24	

Table 3. Sustainable Urban Development Strategy Matrix

IFAS / EFAS	Strenght (+)	Weakness (-)
Opportunity (+)	Increase the capacity of supporting infrastructure to develop the investment in tourism and organic agriculture as basic leading sectors with synergy to empower local manpower and the small-medium enterprises.	Expand the public participation in the planning and controlling of development, including giving feedback on the local government performance.
Threat (-)	Expand the access to affordable house, the education programs, health care and social assistance to alleviate urban poverty.	Improve the quality of forestry and water resources conservation by preventing from degradation and pollution.

5. Conclusion

The development sustainability status of Batu City is sustainable enough, only ecological dimension is less sustainable. Attributes that affect the sustainability status assessment in term of the ecological dimension are water quality, air quality and biodiversity; in review of the economic dimension are investment growth, price stability and tourism visitation; while from socio-culture dimension are poverty, health and security; in term of the dimensions of infrastructure are public sanitation, affordable house and clean water pipeline; and the institutional dimension are development planning, information system and local apparatus. The priority of sustainable urban development strategies of Batu City consist of: Improve the quality of forestry and water resources conservation by preventing from degradation and pollution; Expand the public participation in the planning and controlling of development, including giving feedback on the local government performance; Expand the access to affordable house, the education programs, health care and social assistance to alleviate urban poverty; increase the capacity of supporting infrastructure to develop the investment in tourism and organic agriculture as basic leading sectors with synergy to empower local manpower and the small-medium enterprises. Statistical analysis showed that RAP-CITY method is good enough to be be used as one tool to evaluate the sustainability of urban development by rapid appraisal.

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